Jordan Valley Water Conservancy District

Hazard Mitigation Strategy

Prepared with the assistance of:

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DISTRICT BACKGROUND

Jordan Valley Water Conservancy District (JVWCD) is a political subdivision of the State of Utah. It was created in 1951 under the Water Conservancy Act and was called the Salt Lake County Water Conservancy District. The original Board of Directors was made up of community leaders in Salt Lake County, outside the Salt Lake City service area, including the mayors of Sandy and Midvale, a state legislator and other community leaders. Jordan Valley remains under the administrative jurisdiction of the Third District Court of the State of Utah.

On June 4, 1999, Jordan Valley's name was changed from Salt Lake County Water Conservancy District to Jordan Valley Water Conservancy District to eliminate confusion with Salt Lake County governments and to better reflect Jordan Valley's service area, which includes most of Salt Lake County and a small portion of northern Utah County.

Jordan Valley is governed by a board of eight trustees who represent seven geographical divisions. They are nominated by either the Salt Lake County Council or a city council, depending upon the division they represent. Each trustee is appointed by the Governor for a four-year term.

Jordan Valley is primarily a wholesaler of water to cities and improvement districts within Salt Lake County. It also has a retail service area in unincorporated areas of the county. Jordan Valley is now the largest municipal water district in Utah, with 90% of its municipal water delivered on a wholesale basis to cities and water districts and 10% on a retail basis to unincorporated areas of Salt Lake County. In addition, Jordan Valley treats and delivers water to Metropolitan Water District of Salt Lake & Sandy for delivery to Salt Lake City and Sandy City, even though neither city is within Jordan Valley's service boundaries. Jordan Valley also delivers untreated water to irrigators in Salt Lake and Utah Counties to meet commitments under irrigation exchanges.

HAZARD MITIGATION STRATEGY

Table 1 summarizes the priorities, schedule and funding sources for implementing JVWCD's hazard mitigation measures. A Planning Committee consisting of JVWCD personnel and ABS

assembled Table 1. The components of the table are as

- The first column lists the hazards that were selected in consensus with the District that represent credible potential natural hazard threats to JVW CDôs operation.
- The second column is a line number used f or reference purposes.
- Overall perceived risk is documented in the third column of the table and was developed based on the consensus of the Planning Committee. The f actors considered in assessing risk were: estimated f requency of occurrence, vulnerability/f ragility, and consequences.
- The fourth column of the Table lists the actions identif ied by the Committee that will mitigate the risks associated with the hazards.
- The priority of each action is listed in the f ifth column. All mitigation actions identif ied in this plan were prioritized according to a benefit-cost analysis, with a f ocus on how effective the actions are expected to be with respect to their cost. The top three priorities are listed as ñH1ò, ñH2ò, and ñH3ò.
- The results of the benef it-cost analysis are shown in the sixth column. Benef it-cost ratios were calculated where possible using the f ollowing approach:

  Benef it-cost ratio estimations f or facilities other than the water treatment plants did not lend themselves well to quantitative evaluation, since the impact to system capacity and ope ration for facility loss was not readily quantif iable, and was therefore qualitatively assessed at this time.

  For the two water treatment plants, benef it-cost ratios were quantif ied using the following relationship (see Table 2 f or documentation of the actual calculations).

  Benef it-Cost Ratio = (Probability f or Significant Earthquake Event * Def erred Cost)/Cost for Mitigation

  Where:

  Probability f or Significant Earthquake Event is assumed to be 10%, the probability for a 475-year earthquake over a 50-year time span, which was used in the *JVWCD Seismic Hazard Mitigation Project, Phase 1: Predesign Report,* May 28, 2003.

  Deferred Cost (avoided loss) is the estimated loss of business commerce revenue in the JVWCD service area following the given earthquake event. The loss of business revenue is based on an examination of the annual

estic Product (SDP). Of the total $70.4 billion annual VW CD service area was estimated to contribute 5.2 billion, or $41.8 million on a daily basis. (See Table 3 for calculations of the estimated SDP produced in the JVW CD service area.) Based on the percent of total system capacity, the JVW TP provides approximately 70% of the total capacity and the SERW TP provides approximately 10%, with the system wells providing the remaining 20%. Therefore, the JVWCD total water supply capacity would be reduced by 70% if a critical structure at the JVW TP is rendered inoperable following the event. Similarly, the total water supply capacity would be reduced by 10% if a critical structure at the SERW TP were rendered inoperable. Based on an evaluation of outage impact factors (*Applied Technology Council, (1991), Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United St ates, ATC-25, Redwood City, California: Applied Technology Council*), the estimated daily loss of commerce revenue within the JVW CD service area would be $9.9 million and $0.8 million for the loss of the capacity provided by the JVWTP or SERWTP, respectively. (See Table 4 for calculations of the daily loss of commerce revenue.) The daily loss of revenue due to the reduced water supply is multiplied by the estimated outage duration as shown in Table 2 to compute the deferred cost.

Cost for Mitigation is the cost presented in the *JVWCD Seismic Hazard Mitigation Project, Phase 1: Predesign Report* , May 28, 2003 and in the *JVWCD Seismic Hazard Mitigation Benefit-Cost Analysis Report*, October 6, 2003. These costs have been escalated 3% per year for two years to convert the costs from 2003 dollars into 2005 dollars to account for construction cost escalation between the time of the original cost estimate and the earliest expected construction dates.

A ñHighò benefit-cost ratio corresponds to a ratio calculated or expected to be greater than two. A ñModerateò benefit-cost ratio corresponds to a ratio calculated or expected to be greater than one but less than two. A ñLowò benefit-cost ratio corresponds to a ratio less than one . All ratios shown in Table 2 are above two, and thus a ñHighò benefit-cost ratio was assigned for the water treatment plant seismic upgrades. Potential losses from fires following earthquakes have conservatively been excluded from the benefit-cost calculations. Losses exclude ñfire-followingò losses, which have proven to be significant in historically recent earthquakes such as the 1989 Loma Prieta event and the 1995 Kobe Japan area.

- The implementation deadlines and funding sources to be shown in the last columns of the table will be updated in subsequent revisions.

To be consistent with standardized DMA-2000 grant application processes, a 475 -year, 10% probability in 50 years seismic event has been utilized in this grant application. It is extremely noteworthy, however, to point out that the Wasatch front is very susceptible to a 2475-year, 2% probability in 50 years seismic event based on numerous recent geologic studies. (Ref: Masek,

eria For Water Systemsò, 2002). A very important and other seismically active zones (such as Calif ornia) exist. Specifically, in California the difference between zero period acceleration for a ñ10% in 50 years eventòversus a ñ2% in 50 years eventòis typically on the order of a factor of two. Along the Wasatch range this difference can be a factor of five. This is why the ICBO committees have adopted 2% contours for Utah. In practical laypersonôs terms this all simply means the actual risk to the Utah water systems can be very high. Therefore the importance of proactive mitigation efforts must be emphasized.

Table 1: JVWCD Hazard Mitigation Strategy

		(3) Risk[1,2]	(4) Action	(5) Priority[1,3]	(6) Estimated Cost	(7) Benefit-Cost Ratio[1,5]	(8) Implementation Deadline	(9) Funding Sources
Earthquake (Ground Motion, Liquefaction, Surface Faulting)	1	**H**	Seismic Upgrades for the Jordan Valley Water Treatment Plant: High-rise Filter Gallery (Building Structures) Upper Raw Water Pond Screening Building Flocculation Basins Sedimentation Basins Filter Basins Chemical and Control Building 8 Million Gallon Reservoir Washwater Recycle Pump Station #1	H1	$6,470,000[4]; Cost of construction projects currently underway is $294,000	H[6,7]	Phase 1 Construction: completed FY2004 Planning: FY2004 Design: FY2005-2006 Construction: FY2006-2008	To be determined
	2	**H**	Seismic upgrades for the Administration buildings. A principle concern is life-safety of District employees and use of the facilities after an earthquake.	H2	$2,000,000[4]	H[7,8]	Planning: FY2004 Design: FY2005-2006 Construction: FY2006-2007	To be determined
	3	**H**	Seismic Upgrades for the Southeast Regional Water Treatment Plant: Filter Operations Building Filter Basins	H3	$550,000[4], Cost of construction projects currently underway is $55,500	H[6,7]	Phase 1 Construction: completed FY2004 Other Work: To be determined	To be determined
	4	**H**	Seismic upgrades that includes the installation of flexible couplings or relocation of pipe connections at the following reservoirs: 6200 South 3200 West- 2 MG #1 6200 South 3200 West- 2 MG #2 4500 South 4800 West- 1 MG 4500 South 4800 West- 2 MG	H	$76,000[4]	H[7]	To be determined	To be determined

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	5	**H**	Acquire backup sources of power ï portable diesel generator sets for pump stations in the following output capacities:[11] 800 kW 4160 Volt (3600 West, 10200 South Pump Station) 600 kW 480 Volt (3145 West, 11400 South and 5700 West, 10200 South Pump Stations) 600 kW 2400 Volt (Terminal Reservoir Pump Station) 500 kW 480 Volt (Draper No. 1 and 1300 East, 10700 South Pump Station)	M	To be determined	M	To be determined	To be determined
	6	**M**	Perform structural seismic upgrades for the following reservoirs. There is a concern for localized flooding and damage to property in the vicinity if reservoir contents were released. 2300 East 9800 South- 6 MG 6000 West 4700 South- 6 MG 3600 West 10200 South- 3 MG 5700 West 10200 South- 3 MG	M	$800,000[4]	M[7,12]	To be determined	To be determined
	7	**M**	A raw water or treated water aqueduct may catastrophically fail. Acquire repair segments to reduce the delay in repairing.	H	Small	H[9]	To be determined	To be determined
	8	**M**	Install a parallel pipeline (potentially a 33òline) to either the 4500 South or 6600 South crossing of the Jordan River / liquefaction zone with a seismic-resistant pipeline design.	M	Project-dependent	L	To be determined	To be determined
	9	**M**	Perform seismic upgrades for well house structures.	M	$330,000[4]	H[7]	To be determined	To be determined
	10	**L-M**	Booster pump station seismic upgrades ï There are no pump stations that would be expected to be non-functional in a 475-yr earthquake (10% in 50 years) for which no redundant flow path exists, with the potential exception of the finished water pumps at Jordan Valley Water Treatment Plant that pumps water from the 8 MG reservoir to Bluffdale Cityõs 6 MG reservoir (mainly rural/agricultural area with limited number of industrial customers).	M	$200,000[4]	H[7]	To be determined	To be determined

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	11	**L**	Develop the capability to provide temporary disinfection of groundwater from the wells. Some wells already have this capability and thus more research is necessary to more concretely define this mitigation action. 9 of 27 equipped, 2 portable stations.	M	Small	H[9]	To be determined	District Operations
Building/ Facility Fire/ Explosion or Facility Flood due to burst pipe (includes computer failure)	12	**H**	Ensure adequate procedures and training are in place for minimizing the risks for fire and flooding.	H	Small	H[9]	To be determined	District Operations
Landslide/ Rock Slide (earthquake-related)	13	**H**	There is a concern that a landslide could damage the Salt Lake Aqueduct or the Olmsted Aqueduct. Such damage could result in loss of the Districtõs raw water supply but would be the responsibility of others to repair.[10] No recommended mitigation actions were therefore identified in the *JVWCD Emergency Repairs and Funding Study, Revision 1*, June 2000.	n/a	n/a	n/a	n/a	n/a
Loss of Raw Water Supply (includes dam failure, turbid raw water, contaminated raw water and transportation accident)	14	**H**	Such damage could result in loss of the Districtõs raw water supply but would be the responsibility of others to repair.[10] No recommended mitigation actions were identified in the *JVWCD Emergency Repairs and Funding Study, Revision 1*, June 2000.	n/a	n/a	n/a	n/a	n/a
Power Outage (includes wind/ snow/ ice storm impacts)	15	**H**	Consider obtaining emergency electrical generators as noted above.	See Line 5 above	See Line 5 above	See Line 5 above	See Line 5 above	See Line 5 above

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		(3) Risk[1,2]	(4) Action	(5) Priority[1,3]	(6) Estimated Cost	(7) Benefit-Cost Ratio[1,5]	(8) Implementation Deadline	(9) Funding Sources
Flood in the Jordan River	16	**H**	The operations and maintenance complex may be flooded during a 100-year or 500-year event, resulting in potential loss of SCADA, as well as access to maintenance shops, repair equipment and the emergency operations center. Consider making provisions to have a temporary SCADA system for use at an alternate location. Practice yearly SCADA-free operation for a day. Make provisions to move equipment and vehicles temporarily if flooding threatens. Make provisions for a temporary location for the emergency operations center.	H	Small	H[9]	To be determined	District Operations
	17	**M**	Loss of more than one river-crossing pipeline is unlikely in any flood event. Recommended actions noted above for installing a parallel pipeline to either the 4500 South or 6400 South crossing would further enhance redundancy.	See Line 8 above	See Line 8 above	See Line 8 above	See Line 8 above	See Line 8 above
	18	**M**	Reduce flooding vulnerability of bridge/road to allow access to complex and passage of District vehicles.	L	Project-dependent	L	To be determined	To be determined
	19	**L**	Flooding of the Jordan Narrows Pump Station may require replacement of the electrical control equipment on the floor of the station. This pump station is not used for pumping raw or potable water. No recommended mitigation actions were identified in the *JVWCD Emergency Repairs and Funding Study, Revision 1*, June 2000.	n/a	n/a	JVWCD to investigate potential regional impact	n/a	n/a

Table 1 Notes:

1. L = Low, M = Moderate, H = High

2. Overall perceived risks were developed based on a consensus of the Planning Committee. The factors considered in assessing risk were: estimated frequency of occurrence, vulnerability/fragility, and consequences. Information was utilized from the Emergency Repairs and Funding Study 2000 findings and other reports.

3. A qualitative approach was used to assign action priorities. Generally, priorities were selected that corresponded to benefit-cost ratios; for example, a high benefit-cost action was assigned a high priority. The judgment of the Planning Committee, in some cases determined the assignment of priority.

Seismic Hazard Mitigation Project, Phase 1: Predesign Report, May 28, 2003 and the in *JVWCD Cost Analysis Report*, October 6, 2003 for 475-yr earthquake event (10% probability in 50 years). 3% per year for two years to convert the costs from 2003 dollars into 2005 dollars to account for en the time of the original cost estimate and the earliest expected construction dates.

5. A ñHighò benefit-cost ratio corresponds to a ratio calculated or expected to be greater than two. A ñModerateò benefit-cost ratio corresponds to a ratio calculated or expected to be greater than one but less than two. A ñLowò benefit-cost ratio corresponds to a ratio less than one.

6. Benefit-cost ratios for the two water treatment plants were estimated using the following relationship (see Table 2 for documentation of the actual calculations):

Benefit-Cost Ratio = (Probability for Significant Earthquake Event * Deferred Cost) / Cost for Mitigation

Where:

Probability for Significant Earthquake Event is assumed to be 10%, the probability for a 475-year earthquake over a 50-year time span, which was used in the *JVWCD Seismic Hazard Mitigation Project, Phase 1: Predesign Report,* May 28, 2003.

Deferred Cost (avoided loss) is the estimated loss of business commerce revenue in the JVWCD service area following given earthquake event. The loss of business revenue is based on an examination of the annual Utah State Domestic Product (SDP). Of the total $70.4 billion annual Utah SDP, the JVWCD service area was estimated to contribute approximately $15.2 billion, or $41.8 million on a daily basis. (See Table 3 for calculations of the estimated SDP produced in the JVWCD service area.) Based on the percent of total system capacity, the JVWTP provides approximately 70% of the total system capacity and the SERWTP provides approximately 10%, with the system wells providing the remaining 20%. Therefore, the JVWCD total water supply would be reduced by 70% if a critical structure at the JVWTP is rendered inoperable following the event. Similarly, the total water supply capacity would be reduced by 10% if a critical structure at the SERWTP were rendered inoperable. Based on an evaluation of outage impact factors (*Applied Technology Council, (1991), Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States, ATC-25, Redwood City, California: Applied Technology Council*), the estimated daily loss of commerce revenue within the JVWCD service area would be $9.9 million and $0.8 million for the loss of the capacity provided by the JVWTP or SERWTP, respectively. (See Table 4 for calculations of the daily loss of commerce revenue.) The daily loss of revenue due to the reduced water supply is multiplied by the estimated outage duration as shown in Table 2 to compute the deferred cost.

Cost for Mitigation is the cost presented in the *JVWCD Seismic Hazard Mitigation Project, Phase 1: Predesign Report*, May 28, 2003 and in the *JVWCD Seismic Hazard Mitigation Benefit-Cost Analysis Report*, October 6, 2003. These costs have been escalated 3% per year for two years to convert the costs from 2003 dollars into 2005 dollars to account for construction cost escalation between the time of the original cost estimate and the earliest expected construction dates.

are above two, and thus a ñHighò benefit-cost ratio was assigned for the water treatment plant seismic
s from fires following earthquakes have been excluded from the benefit-cost calculations.

oped for JVWCD in the *JVWCD Seismic Hazard Mitigation Benefit-Cost Analysis Report*, October 6, 2003. The benefit-cost ratios in this report conservatively do not include any potential loss of business commerce revenue or losses from fires following earthquakes.

8. The benefit-cost ratio for the administration complex was determined from the ratio provided in the *JVWCD Seismic Hazard Mitigation Benefit-Cost Analysis Report*, October 6, 2003 and a factor to account for the potential loss of life at the facility since the facility houses on average of at least 50 employees or visitors at any time.

9. Mitigations that have small estimated costs were assigned high benefit-cost ratios.

10. Agencies with responsibility to repair damage: Central Utah Water Conservancy District (CUWCD) and Bureau of Reclamation (BOR)

11. Reference: *JVWCD Evaluation for Standby Power*, April 2000.

12. The benefit-cost for these reservoirs could also include applicable possible fire following and liabilities caused by local flooding.

r JVWCD Water Treatment Plant Seismic Upgrades

Facility	Asset	Outage Duration (days)[1]	Deferred Cost[2]	Cost for Mitigation[3]	Benefit-Cost[4]
Jordan Valley WTP	High-rise	180	$1,785,300,000	$2,632,000	68
	Filter Gallery (Building Structures)	30	$297,600,000	$1,030,000	29
	Upper Raw Water Pond	2	$19,800,000	$501,000	4
	Screening Building	2	$19,800,000	$105,100	19
	Flocculation Basins	3	$29,800,000	$83,800	36
	Sedimentation Basins	3	$29,800,000	$584,100	5
	Filter Basins	30	$297,600,000	$243,600	122
	Chemical and Control Building	30	$297,600,000	$704,200	42
	8 Million Gallon Reservoir	5	$49,600,000	$267,000	19
	Washwater Recycle Pump Station #1	1	$9,900,000	$29,000	34
Southeast Regional WTP	Filter Operations Building	30	$22,900,000	$427,200	5
	Filter Basins	30	$22,900,000	$66,100	35

Table 2 Notes:

1. The outage duration are engineering estimates on the expected time duration before normal or sufficient water treatment capacity can be restored. The time estimates include consideration of the existing un-retrofitted condition of the facilities, the expected damage that may be caused by the seismic event at each facility, and the potential time it would take to repair the structures for reoccupation and water treatment use. These durations are based heavily on engineering judgment and may vary under actual conditions.

2. Deferred cost represents the estimated impact to business commerce in the JVWCD service area due to the reduced water supply over the assumed outage duration. See Table 3 for the estimate of the Utah State Domestic Product (SDP) produced in the JVWCD service area. The deferred cost calculations assume that the available JVWCD water supply capacity is reduced by 70% if a structure at the JVWTP is rendered inoperable following the event and 10% if a structure at the SERWTP is rendered inoperable. See Table 4 for estimated daily commerce revenue losses as a percentage of the interruption in supply.

3. Costs were developed in *JVWCD Seismic Hazard Mitigation Project, Phase 1: Predesign Report*, May 28, 2003 and the in *JVWCD Seismic Hazard Mitigation Benefit-Cost Analysis Report*, October 6, 2003 for 475-yr earthquake event (10% probability in 50 years). These costs have been escalated 3% per year for two years to convert the costs from 2003 dollars into 2005 dollars to account for construction cost escalation between the time of the original cost estimate and the earliest expected construction dates.

4. These values are all greater than 2, and therefore seismic upgrades for the water treatment plants have been assigned to be ñHighò in Table 1.

roduct (SDP) Produced within the JVWCD Service Area

Market Sector	(A) Utah Annual SDP (millions)[1]	(B) % of Total SDP produced in JVWCD Service Area[2]	(C) JVWCD Service Area Annual Domestic Product (millions)[3]	(D) JVWCD Service Area Daily Domestic Product (thousands)[4]
Agriculture, Forestry, and Fishing	$874	15%	$131	$359
Mining	$1,323	30%	$397	$1,087
Construction	$4,357	25%	$1,089	$2,984
Manufacturing	$8,079	20%	$1,616	$4,427
Transportation and Public Utilities	$5,595	25%	$1,399	$3,832
Wholesale Trade	$4,243	25%	$1,061	$2,906
Retail Trade	$6,989	25%	$1,747	$4,787
Finance, Insurance, and Real Estate	$14,135	15%	$2,120	$5,809
Services	$14,498	25%	$3,625	$9,930
Government	$10,315	20%	$2,063	$5,652
TOTAL:	**$70,408**		**$15,248**	**$41,774**

Table 3 Notes:

1. The Utah State Domestic Product is for year 2001 and is referenced from the Buraeu of Economic Analysis, an agency of the U.S. Department of Commerce. See the following website for backup data: http://www.bea.gov/bea/regional/gsp

2. The percentages of each market sector that JVWCD serves are only approximate. Actual percentages may be within plus or minus 10%. Through wholesale and interconnections with other water districts, JVWCD provides water, in one way or another, to approximately 80-90% of the Salt Lake County population and industries. Salt Lake County comprises approximately 40% of the total population of the State of Utah and hence approximately 40% of the Utah SDP. See the following website for additional backup data: http://www.bea.gov/bea/regional/reis

3. The JVWCD service area contribution to the annual SDP in each market sector is determined by multiplying column (A) by column (B).

4. The average daily portion of the SDP that the JVWCD service area contributes to each market sector is determined by dividing the annual contribution (column (C)) by 365 days.

usiness Commerce Loss in JVWCD Service Area
n assumed Interruption of Supply)

Market Sector	Impact Factor for **10%** Interruption of Supply[1, 3]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]	Impact Factor for **30%** Interruption of Supply[1]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]	Impact Factor for **50%** Interruption of Supply[1]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]
Agriculture, Forestry, and Fishing	2.81%	$10	14.03%	$50	25.27%	$91
Mining	0.79%	$9	3.95%	$43	7.11%	$77
Construction	2.63%	$78	13.16%	$393	23.68%	$707
Manufacturing	3.35%	$148	16.76%	$742	30.16%	$1,335
Transportation and Public Utilities	1.58%	$61	7.90%	$303	14.21%	$545
Wholesale Trade	1.05%	$31	5.26%	$153	9.47%	$275
Retail Trade	1.05%	$50	5.26%	$252	9.47%	$453
Finance, Insurance, and Real Estate	1.05%	$61	5.26%	$306	9.47%	$550
Services	2.42%	$241	12.10%	$1,202	21.79%	$2,164
Government	1.32%	$75	6.58%	$372	11.48%	$669
TOTAL:		**$763**		**$3,815**		**$6,866**

Market Sector	Impact Factor for **70%** Interruption of Supply[1, 3]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]	Impact Factor for **90%** Interruption of Supply[1]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]	Impact Factor for **100%** Interruption of Supply[1]	JVWCD Service Area Daily Domestic Product Loss (thousands)[2]
Agriculture, Forestry, and Fishing	36.49%	$131	47.72%	$171	53.33%	$192
Mining	10.26%	$112	13.42%	$146	15.00%	$163
Construction	34.21%	$1,021	44.74%	$1,335	50.00%	$1,492
Manufacturing	43.57%	$1,929	56.98%	$2,522	63.68%	$2,819
Transportation and Public Utilities	20.53%	$787	26.84%	$1,029	30.00%	$1,150
Wholesale Trade	13.68%	$398	17.89%	$520	20.00%	$581
Retail Trade	13.68%	$655	17.89%	$856	20.00%	$957
Finance, Insurance, and Real Estate	13.68%	$795	17.89%	$1,039	20.00%	$1,162
Services	31.47%	$3,125	41.16%	$4,087	46.00%	$4,568
Government	17.11%	$967	22.37%	$1,264	25.00%	$1,413
TOTAL:		**$9,919**		**$12,970**		**$14,497**

Table 4 Notes:

1. Percentage impact factor to JVWCD service area domestic product, by market sector, for given losses of water supply *(Applied Technology Council, (1991), Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States, ATC-25, Redwood City, California: Applied Technology Council).* Impact factors estimates are specific to the State of Utah.

2. Daily loss of commerce revenue in the JVWCD service area is determined by multiplying the percentage impact factor by the estimated average daily portion of the SDP that the JVWCD service area contributes (column (D) in Table 3). For example, if JVWCD is able to supply only 90% of the service area water requirements (a 10% interruption), output from the agriculture, forestry, and fishing market sector is estimated to be reduced by 2.81%.

3. Based on total system capacity, 10% and 70% interruption in supply were selected as a reasonable estimate of the potential effects due to a critical structure at the SERWTP or a critical structure at the JVWTP being rendered inoperable after a large earthquake event affecting the JVWCD service area.